

## HABITAT USE OF THE NORTHERN HARRIER IN A COASTAL MASSACHUSETTS SHRUBLAND WITH NOTES ON POPULATION TRENDS IN SOUTHEASTERN NEW ENGLAND

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**ABSTRACT.**—Northern Harrier (*Circus cyaneus*) use of a 55.3 ha, shrub-dominated coastal peninsula in Massachusetts was monitored, year-round, from 19 February 1987 to 26 April 1988. In 1987, two harrier pairs established breeding territories there. Two nests with eggshells were found, and represent the only documented harrier nesting attempts on mainland Massachusetts (excluding Cape Cod) in more than a decade. Both nests were situated within patches of low ( $0.93 \pm 0.28$  m), dense shrubs dominated by Black Huckleberry (*Gaylussacia baccata*). Each winter, most harriers roosted within the same two patches of dense Black Huckleberry ( $\bar{X}$  shrub height =  $0.84 \pm 0.18$  m). The maximum count of harriers at the winter roost site was 23 during February of 1988 (3 adult male, 20 brown). Though the number of breeding harriers in Southeastern New England has declined during this century, analysis of Christmas Bird Count data from 1962 to 1988 demonstrates an increase in the number of wintering harriers in the same region during that period.

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Uso del habitat por el *Circus cyaneus* en un terreno de arbustos de una costa de Massachusetts, con notas sobre las tendencias de población en el sudeste de Nueva Inglaterra

**EXTRACTO.**—Desde el 19 de febrero de 1987 hasta el 26 de abril de 1988, se han hecho observaciones del uso que hacen las aves raptoras *Circus cyaneus*, de 55.3 hectáreas pobladas de arbustos, en la costa de la península de Massachusetts. En 1987, esta área fue el territorio nupcial de dos parejas de estas aves raptoras. Dos nidos con cáscaras de huevos han sido hallados y representan los únicos indicios, en más de una década, de las tentativas de anidar que las raptoras de esta especie han dejado en tierra firme de Massachusetts (excluyendo Cape Cod). Los dos nidos estaban situados dentro de pequeñas áreas pobladas densamente por bajos arbustos ( $0.93 \pm 0.28$  m) en los que domina el arándano negro (*Gaylussacia baccata*) ["Arándano = . . . Planta de la familia de las ericáceas . . . con ramas angulosas, hojas alternas . . . frutos bayas negruzcas o azuladas, dulces y comestibles. . ."]. Cada invierno, la mayor parte de estas aves descansaban dentro de esas dos áreas pobladas por densos arándanos ( $\bar{X}$  altura por planta =  $0.84 \pm 0.18$ ). El máximo número de estas aves en estos lugares de descanso invernal fue de 23 (3 adultos machos, 20 marrones), en febrero de 1988. Aunque el número de estas aves de rapiña durante el ciclo reproductivo, en el sudeste de Nueva Inglaterra, ha declinado durante esta centuria, los análisis del cómputo de aves, realizado en las épocas navideñas, desde 1962 a 1988, demuestran un aumento en el número de ellas, en los inviernos, en la misma región durante ese período.

[Traducción de Eudoxio Paredes-Ruiz]

The Northern Harrier (*Circus cyaneus hudsonius*) is found year-round in southeastern New England. Although there is evidence to suggest that numbers of wintering harriers have increased in this region during recent years (Christmas Bird Count data in Audubon Field Notes 1962-1970, and American Birds 1971-1988), numbers of breeding harriers have declined during this century (Forbush 1927, Bent 1937, Griscom and Snyder 1955, Hill 1965, Serrentino and England 1989, Nikula and Holt, in

prep.). Breeding harriers have been nearly extirpated from mainland habitats in Connecticut, Massachusetts and Rhode Island (Serrentino and England 1989). Breeding populations persist in Massachusetts on Cape Cod and offshore islands, and on Block Island, Rhode Island (Serrentino and England 1989, Nikula and Holt, in prep.). The harrier is an endangered species in Rhode Island, and is listed as threatened in Massachusetts (no status available for Connecticut).

Serrentino and England (1989) reported on the diminishing number of nesting harriers in the Northeast, and suggested areas of research for de-

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veloping effective management/recovery strategies for the species. Here, we provide detailed, year-round data on the habitat use of harriers at Barney's Joy Point, a coastal shrubland in southeastern (mainland) Massachusetts. We monitored winter roosting activity beginning February 1987, and in April 1987 documented the establishment of breeding territories by two male harriers. A nest found in one of the territories represents the first documented harrier nesting attempt in mainland Massachusetts (excluding Cape Cod) in more than a decade, and a nest from the previous breeding season (with eggshell fragments) was also discovered.

#### STUDY AREA

The study area, Barney's Joy Point, is a shrub dominated coastal peninsula in South Dartmouth, Massachusetts (Fig. 1). The 55.3 ha study area is bordered to the northwest by a coastal dune system and tidal pond/marsh complex. Cultivated fields lie to the north of the study area, and the remainder of the point is surrounded by the waters of the Slocum's River to the east, and Buzzard's Bay to the south and southwest. Harriers hunted in habitats adjacent to the study site, however all breeding and most roosting occurred within the boundaries of the study area. Although cattle grazing in past years has left an extensive network of cowpaths throughout the area, it is presently used as pasture for less than twenty cattle in the summer.

We classified the habitats of the study area into five types. Shrub/herb (14.8 ha, 26.8% total area) occupies two tracts of pasture land in the northern and northeastern zones of the study area (Fig. 1). Several small, seasonal freshwater pools are found within the northeastern tract. Shrub/herb is characterized by a complete ground cover of grasses and forbs occurring beneath a sparse 1- to 2-m tall shrub overstory. Shrubs are denser and taller (2-4 m) along remnant hedgerows and within a few small patches within this community. Dominant shrubs are Black Huckleberry (*Gaylussacia baccata*), Highbush Blueberry (*Vaccinium corymbosum*), Dwarf Sumac (*Rhus copallina*), and Northern Arrowwood (*Viburnum recognitum*).

Grassland (6.5 ha, 11.8% total area) covers two tracts that are interspersed with the shrub/herb tracts in the northern section of the study area (Fig. 1). This habitat is maintained by annual mowing and is dominated by Red Fescue (*Festuca rubra*) and Wavy Hair Grass (*Deschampsia flexuosa*). Various forbs are also present.

Dense shrub/grassland (16.9 ha, 30.6% total area) occupies a wide band in the center of the study area (Fig. 1). It is characterized by dense, 0.5- to 2-m tall patches of Black Huckleberry (62% of total area) with pockets of short (<30 cm) grasses (38% total area) interspersed among the shrub patches. Subdominant shrubs include Bayberry (*Myrica pensylvanica*), Virginia Rose (*Rosa virginiana*) and Pasture Rose (*Rosa carolina*). Grassy areas are dominated by Red Fescue and Wavy Hair Grass. Several junipers (*Juniperus virginiana*), most less than 3 m tall, are scattered throughout the community.

Dense shrub/dune (7.7 ha, 13.9% total area) is found in a band along the southwestern edge of the dense shrub/grassland habitat (Fig. 1). This habitat consists of low, rolling sand dunes with numerous, small (<50 m<sup>2</sup>) patches of low ( $\leq 0.5$  m) shrubs interspersed among herbaceous dune vegetation and areas of unvegetated sand. Black Huckleberry and Seaside Rose (*Rosa rugosa*) are the dominant shrubs; American Beachgrass (*Ammophila breviligulata*) and Beach Heather (*Hudsonia tomentosa*) dominate the herbaceous community.

Beachgrass dune (2.6 ha, 4.7% total area) occupies the southwestern corner of the study area (Fig. 1). This habitat consists of primary and secondary sand dunes, and is covered almost entirely by American Beachgrass. Other species include Dusty Miller (*Artemisia stelleriana*), Seaside Goldenrod (*Solidago sempervirens*), and Seaside Rose. Areas of unvegetated sand are also present.

A brackish pond (0.8 ha, 1.4% total area) is located adjacent to the shoreline on the eastern side of the study area. Unpaved roads and rocky shoreline comprise the remaining 0.3 ha (0.5%) and 5.7 ha (10.3%) of the study area, respectively.

#### METHODS

Observations of harriers at Barney's Joy were made from 19 February 1987 to 26 April 1988. That period encompassed one full breeding season, which we defined as 9 April (initiation of courtship behavior) to 31 July 1987. We made 93 hours of observations during that breeding season. We observed harriers for 57 hours during the 86-87 roost period and for 112 hours during the 87-88 roost period. Most roost observations in 87-88 were made during evenings. However, between 12 January and 10 March 1988, weekly counts were made during the morning by two observers, each counting the number of harriers leaving roosts. Observers arrived approximately 30 minutes before sunrise and remained until dispersal activity ceased, up to 1 hour after sunrise.

A cover map of the study area (Fig. 1) was made from 1:9600 scale black and white vertical aerial photographs. Habitat patches >50 m<sup>2</sup> were delineated with the aid of a 4 $\times$  lens stereoscope and an 8 $\times$  monocular lens. We also delineated two areas where most wintering harriers roosted. We did not attempt to delineate breeding territory boundaries. The areas of each habitat type and of the two winter roosts were measured on an enlarged (1:4048 scale) cover map using a dot-grid and compensating polar planimeter.

After the 1987 breeding season, shrub heights were estimated within each of the two principal roost sites, and within the shrub/herb and dense shrub/grassland habitats. Within each area sampled, two transects perpendicular to one another, and crossing at an approximated center of the area, were established; the bearing of the first transect was determined randomly. Shrub height and species were noted at 10-m intervals (5 m within roost sites) across the full length of each transect. No data were taken if the sample point fell in an herbaceous patch.

The percent cover of habitat types surrounding the two nest sites was estimated along four, 5-m transects extending out from each nest (Holt and Melvin 1986, Brower

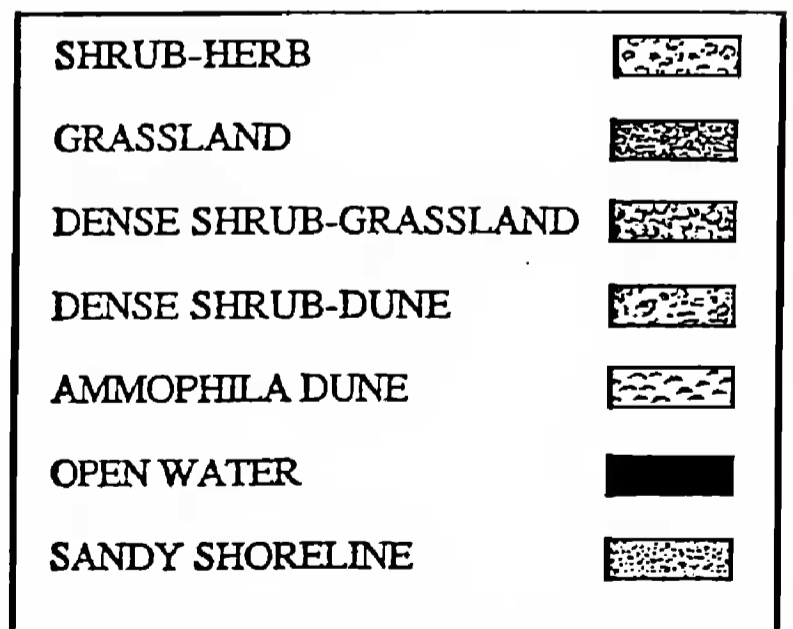
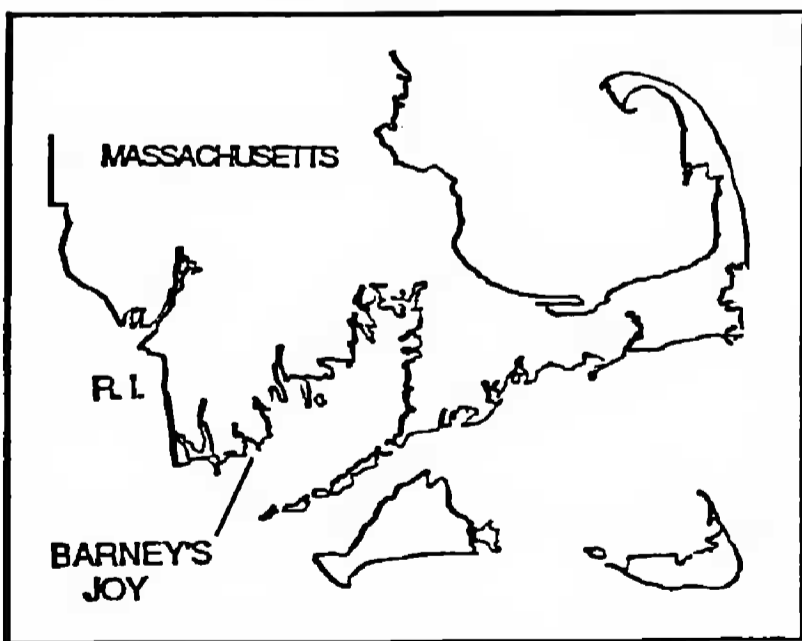
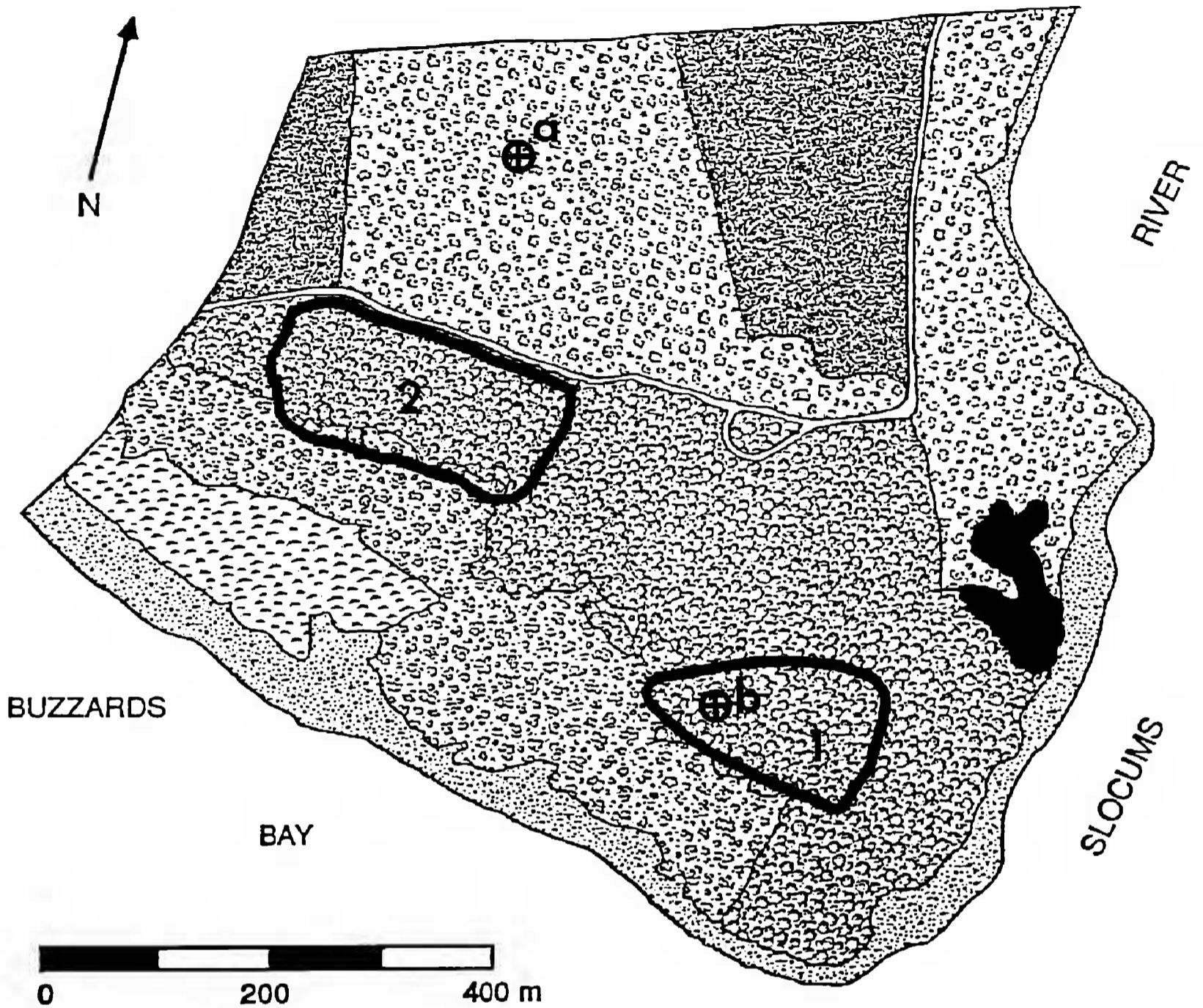


Figure 1. Distribution of habitats at Barney's Joy Point, South Dartmouth, Massachusetts. Delineated areas represent winter roosts 1 and 2. Circled "+" signs indicate the sites of nests a and b.

and Zar 1977). The transects were then extended from the nest to the edge of the patch of shrubs within which it occurred to determine the mean distance from each nest to the edge of its patch (Holt and Melvin 1986).

To assess population trends of wintering harriers in southeastern New England, we determined the mean number of harriers counted per party hour (Raynor 1975) across 17 Christmas Bird Count (CBC) census-circles in Massachusetts (9 circles), Connecticut (6 circles) and Rhode Island (2 circles) for each year from 1962 to 1988. CBC census-circles with no reported harrier observations during that period were excluded from our analysis. Also excluded were census-circles that were not censused during each year of that period. We chose 1962 as a starting point since several CBC census-circles with substantial harrier counts were added in that year.

#### RESULTS AND DISCUSSION

**Year-round Activity.** Six to ten harriers (including 2 adult males) roosted at Barney's Joy from February through March 1987. Behavior suggesting defense of a breeding territory was seen for the first time on 1 April 1987, when one male was seen escorting (Bildstein and Collopy 1985) another for approximately 8 minutes in the evening. Immature harriers were seen for the last time on 9 April, coinciding with the first day an adult male was seen performing aerial courtship displays. By 15 April, two male harriers had established breeding territories, the first of which (Territory 1) was centered in the larger shrub/herb field, and the second (Territory 2) in the dense shrub/grassland habitat tract of the study area (Fig. 1). The two males repeatedly engaged in escorting flights along a line where the two territories met. Female harriers were frequently seen within the study area at that time.

Courtship behaviors, including skydancing and aerial food transfers (Hamerstrom 1986) peaked during the 3rd week in April, and by late April two breeding pairs were established. Copulation (Territory 1 pair) was first seen on 30 April, and on 27 May a female was nest-building. Occasional food transfers were observed until the end of June; however, neither of the pair from Territory 1 was seen during July. A nest containing eggshell fragments was found in Territory 1 on 31 July; the eggs had apparently been destroyed by a mammalian predator.

The male from Territory 2 was seen carrying nesting material on 7 May. The female of this pair was never associated with a nest, and was last seen on 28 May. An incomplete nest was found in Territory 2 on 24 June; we believe that that nest was built by the male as observed by Hamerstrom (1986).

A lone male roosted in this territory throughout the remainder of the breeding season.

After the 1987 breeding season, harriers began roosting at Barney's Joy in mid-September, and by mid-October, 4 to 6 birds were roosting regularly within the same shrub patches as those used the previous winter. Throughout the 87-88 winter roost period there were substantial fluctuations in the numbers of roosting harriers. A maximum count of 23 (including only 3 adult males) was made on 12 January 1988; numbers then decreased over the next two weeks and levelled at approximately 15 until 25 February, after which numbers steadily decreased until the last count of two brown birds on 14 April.

A brush fire on 19 March 1988 consumed 25.7 ha (46.5%) of the study area, including most shrub/herb, dense shrub/grassland, and grassland habitats. For the remainder of the study period, only a few female or immature harriers roosted in the area, and no breeding territories were established at Barney's Joy during 1988.

**Roosting Behavior and Habitat.** Harriers generally left roosts between 20 min before and 40 min after sunrise, with most leaving approximately 10 min before sunrise. In the evening, single harriers began arriving at the roost approximately 40 min before sunset. Most had entered the roost area by 10 min past sunset, and the greatest number of harriers could be seen at this time. These behaviors are consistent with the findings of Weller et al. (1955) in Missouri, and Bosakowski (1983) in New Jersey.

Harrier roosting sites were concentrated within two large patches of dense Black Huckleberry (within dense shrub/grassland) in both years (Fig. 1). Roost 1 (1.9 ha) had 74.9% dense shrub cover; Roost 2 (2.6 ha) had 73.3% dense shrub cover. The mean height of shrubs in Roost 1 was 68.7 cm (SD  $\pm$  21.8 cm) and in Roost 2, 83.7 cm (SD  $\pm$  17.6 cm). Roosting harriers avoided patches of shorter shrubs (<0.3 m), which were interspersed with the taller shrub patches in Roost 1.

Harriers roosted in dune swales to the west of the study area for more than a month after fire removed shrub cover from most of Roost 1. Although shrub height in shrub/herb was not significantly different than that in dense shrub/grassland ( $\bar{X}$  = 84.8 cm and 82.2 cm, respectively), harriers did not roost in the former, suggesting that dense shrub patches are preferred over sparse stands as roosting sites.

Within roost areas, harriers used three site-types for roosting: (1) small patches of flattened forbs with-

in the shrubs; (2) completely or partially flattened shrubs; and (3) narrow, grass covered cowpaths within the shrub patches. Most individual roost sites were smaller than 0.25 m<sup>2</sup>, and biweekly pellet collection demonstrated that harriers were generally faithful to these sites for several days or weeks at a time. Occasionally, feces and pellets would be piled on opposite sides within a site, indicating that the harrier had spent several nights in the same position on the ground. Harriers infrequently roosted together in the same opening within a shrub patch. Though the harriers used the same shrub patches for roosting during each winter period, the actual roost sites used within the patches were not the same in each year.

**Breeding Season Habitat.** Both breeding territories were centered in shrub-dominated habitats. The mean height of shrubs sampled in Territory 1 (shrub/herb) was 84.8 cm (SD  $\pm$  32.6), and in Territory 2 (dense shrub/grassland), 82.2 cm (SD  $\pm$  29.3).

The two nests found with eggshell fragments were both within patches of dense shrubs of the same height ( $0.93 \pm 0.28$  m). The 1987 nest (Territory 1) was placed in a patch of dense huckleberry within the generally sparser, shrub/herb habitat, near the highest elevation of the study area (Fig. 1, nest a). Sumac, Northern Arrowwood and blueberry were subdominant shrubs at that site. The nest from the 1986 breeding season (found while sampling vegetation characteristics within the boundaries of Territory 2) was situated on a low hummock, uniformly covered with very dense huckleberry, Virginia Rose and Pasture Rose (Fig. 1, nest b).

The habitat used by breeding harriers at Barney's Joy was similar to that of harriers nesting on Nantucket Island, Massachusetts in 1985 (Holt and Melvin 1986). There, as at our study site, nests were placed in dense shrub patches within shrub-dominated territories. The mean distance from the Nantucket nests to the edge of the shrub patch within which they occurred (i.e., nearest herbaceous vegetation) was 14.3 m (range = 3.1–27.0 m) (Holt and Melvin 1986); the mean for the two nests at Barney's Joy was 17.3 m (10.8 and 27.7 m).

Thus, although historical accounts of harriers in southeastern New England do not list upland habitats as nesting sites (Forbush 1927, Bent 1937, Griscom and Snyder 1955, Hill 1965), such sites are now relatively common. This suggests that harriers have

moved into upland sites in recent decades, or alternatively, that upland sites went unnoticed by previous investigators. F. Hamerstrom (pers. comm.) theorizes that harriers have been forced to breed in shrub communities as more preferred nesting habitats have become scarcer. Regardless of the reason, coastal upland-shrub habitats should be considered as potential harrier nesting areas when conducting surveys of breeding harriers, or of potential breeding habitat.

**Harrier Population Trends in Southeastern New England.** As early as 1927 Forbush (1927: 100) noted that harriers were "formerly much more common" in New England, and subsequent accounts provide evidence that a decline in the number of breeding harriers has continued throughout this century (Bent 1937, Griscom and Snyder 1955, Hill 1965, Serrentino and England 1989, Nikula and Holt, in prep.).

Presently, only 8–10 pairs are believed to nest on Cape Cod, and the islands of Martha's Vineyard and Nantucket each support about 25 pairs (Nikula and Holt, in prep.). The harrier has been extirpated from mainland Connecticut and Rhode Island, and Barney's Joy represents the only known mainland (excluding Cape Cod) breeding site in Massachusetts (T. French, pers. comm.). Nikula and Holt (in prep.) cite loss of habitat as the principal reason for the marked reduction in the number of breeding harriers in Massachusetts. Serrentino and England (1989) broaden that explanation to include all of the Northeast. Both cite loss of coastal wetlands and the reforestation of farmlands as the principal factors relating to habitat loss.

Serrentino and England (1989:42) noted that "Harrier populations do not appear to have decreased as drastically on their wintering grounds in the Northeast compared to the decline in the number of breeding birds. . . ." That premise is supported for southeastern New England by our relatively high counts of wintering harriers at Barney's Joy, and by Reinert (1984), who observed as many as five harriers hunting simultaneously during the winter at Sachuest Point, Rhode Island, where harriers do not breed. Results of the Christmas Bird Count analysis indicate a trend of increasing numbers of wintering harriers in southeastern New England beginning in 1975, with a leveling off occurring from 1983–1988 (Fig. 2). The mean number of harriers per 100 party hours was 3.66 from 1962–1966, and 5.35 from

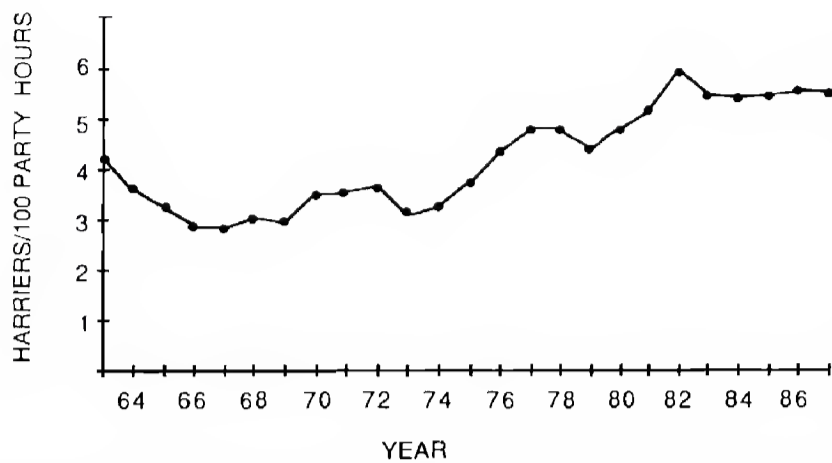


Figure 2. Three-year moving average of number of harriers seen per 100 party hours during Christmas Bird Counts, cumulatively for 17 census-circles in Massachusetts, Connecticut and Rhode Island, for years 1962–1988.

1984–1988, which represents an increase of 46% during the 27-year period. We found no significant relationships between harrier numbers and mean temperature or snow cover during the same 27-year period.

Thus, while the number of breeding harriers in southeastern New England has decreased during recent decades, there is substantial evidence to suggest that wintering numbers have increased. This indicates that (1) a pool of harriers, which represents potential nesting birds, departs from the region at the end of the winter roost period, and (2) factors which do not operate in the winter are acting to limit the number of harriers that remain in southeastern New England to breed. Serrentino and England (1989) suggest that harriers leave wintering areas with potentially suitable nesting habitat due to the increased use of coastal areas by humans during the breeding season months. This explanation seems plausible at areas such as Barney's Joy and Sachuest Point, where nearby beaches attract many visitors and seasonal residents in the spring and summer seasons. However, it is premature to attribute the opposing seasonal trends in harrier populations solely to this explanation. Other factors, such as migration patterns, seasonal changes in prey availability, and attraction to natal breeding areas, may also play roles. An understanding of these factors is essential in developing effective management strategies for breeding harriers, and we urge wildlife researchers elsewhere in the Northeast to initiate investigations in this area. Of particular interest would be studies of (1) harrier movements as they disperse from their

winter roosts (via marking or radiotelemetry), and (2) the relationships between the prey base and harrier nesting and roosting habitats.

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